Opportunities for Working Capital Fund Organizations and Their Customers

Six Financial Challenges

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"Who of us would not be glad to lift the veil behind which the future lies hidden; to cast a glance at the next advances of our science and at the secrets of its development during future centuries?"

Thus spoke Professor David Hilbert in 1900 before the International Congress of Mathematicians in Paris, as he presented 23 unsolved mathematical problems to his colleagues and the world.

Hilbert, who was a brilliant mathematician, wanted to challenge his colleagues in areas that would yield rich rewards by advancing the science of mathematics. So Hilbert presented a set of problems designed specifically to accomplish that goal. He knew the problems must have solutions; he and his colleagues just didn't know what those solutions were. And he realized the enrichment of the science of mathematics did not come necessarily from the solutions themselves, but rather from the pursuit of those solutions. History proved him to be right.

But the purpose here is not to talk about mathematical problems. Rather, the purpose here is to make an attempt at applying Hilbert's approach to financial challenges facing Working Capital Fund (WCF) organizations.

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Why?

Today's WCF organizations face financial challenges. These are not challenges from a perspective that such organizations are somehow financially challenged. Quite the contrary—these are challenges from a perspective that the business environment of WCF organizations continues to evolve and, therefore, the financial tools employed by these organizations must evolve, too. The evolution never ceases.

Behind these challenges lie opportunities for cost avoidance and improved efficiencies—all to the benefit of the customer and the program manager. Behind these challenges lie the best business practices being called for by the Secretary of Defense, the authors of the *Quadrennial Defense Review*, and countless others.

The economics of a WCF is not treated today as a science. But that doesn't mean it shouldn't be. Maybe it should be, and maybe we should follow Hilbert's example. Like Hilbert's mathematical problems, solutions to certain financial challenges currently elude us. Given enough time and effort, however, solutions can be found.

Although mathematical in nature, the financial challenges presented here are significantly different from Hilbert's 23 unsolved mathematical problems. The solutions to these challenges do not require great genius. In most cases, it's as simple as applying commercial practices to government organizations.

Nevertheless, these challenges are important and finding solutions may greatly benefit the way in which business is done. If for no other reason, solutions should be sought because *public service is a public trust.*

Working Capital Fund

Let's start with a brief summary on the economics of a WCF, which relies on sales revenue rather than direct appropriations to finance its continuing operations. The mechanics are really quite simple. A WCF intends to: 1) generate sufficient revenue to cover the full costs of its operations, and 2) operate on a break-even basis over time (no profit and no loss).

Customers, who generally can choose where to purchase services, use appropriated funds to finance orders placed with a WCF organization. So in a sense, a WCF organization operates very much like a private business, except for the absence of profit. In fact, it's designed to work that way, as a means of providing managers with a powerful incentive to control costs and satisfy customers.

Life, of course, does not work as perfectly as theory, and WCF organizations occasionally wind up at the end of the fiscal year with a profit or a loss. Profit at the end of the year indicates that customers paid too much for products and services, resulting in a gain to the WCF. Profits are returned to customers by a forced reduction in the future labor rates charged to customers. Loss at the end of the year means that customers paid too little, resulting in a drain to the WCF. Losses are recovered by increasing the future labor rates charged to customers. It's as simple as that.

Six Financial Challenges

So what are some of the financial challenges facing WCF organizations? The reader may recognize that all of the challenges are interrelated and should recognize that solving these challenges could yield a holistic way of managing the business of the organization.

Per Capita Contributions to U.S. Growth Rates—1929 to 1982

Contributions Due To	Percent Contribution
Labor Input Except Education	-12%
Education	27%
Capital	20%
Advances in Knowledge	55%
Improved Resource Allocation	16%
Economies of Scale	18%
Other	-24%

From Denison, Trends in American Economic Growth, 1929 - 1982, Brookings Institution

Challenge 1—Projecting Future Revenues with High Precision

A basic necessity of any large business is to know the future business base *a priori.* Otherwise, meaningful and efficient planning in critical investment areas such as hiring, capital equipment, infrastructure, and so on is all but impossible. As instructed by John Kenneth Galbraith, uncertainty in the planning sector is despised.

For a WCF organization, the future business base is whatever's contained in official budget submittals. And many organizations have come to find that official budget submittals, which rely heavily on information from program managers and other customers concerning future orders, tend to reflect something quite different from reality. But if investment decisions made today are based on inaccurate revenue projections, how good are those investment decisions, and what is the impact on the organization? The answer is only too obvious.

Some existing techniques, primarily statistical, can be applied to improve our knowledge of things such as future revenues. For example, the difference between historical projections of revenue and actual revenues can be looked upon statistically as *errors*. In certain cases, and with a sufficient database of historical errors, today's official budget projections can be *corrected*, yielding a more accurate view of the future. Standard, regression techniques can also help further *correct* official budget projections when some future orders are in fact known *a priori.* And of course, still other available regression techniques can be applied to take advantage of underlying processes (such as customer habits) when they become known.

None of this would change official budget submittals. But this would give the decision maker a more accurate view of the future. So the challenge here is to apply accepted mathematical tools to develop an expected value of revenue as a means of knowing the future and making better-informed investment decisions.

Challenge 2—Optimizing Cash on Hand

Cash is a non-earning asset and, therefore, cash balances should be minimized. The sooner cash is spent, the sooner it begins working for the organization. Therefore, cash on hand incurs an *opportunity* cost.

This is a good rule from a business school, but how does it apply to a WCF organization? Some WCF organizations maintain sizeable cash balances during the year as a means of avoiding risk. After all, what if expected revenues later in the fiscal year fail to materialize, thus causing the organization to end the year in the red? As previously discussed, a loss is compensated for by increases to labor rates, perhaps driving future business away and introducing the ever-feared *Death Spiral* (see Challenge 3). That's the cost of *illiquidity* in the WCF.

So having too much money on hand incurs an *opportunity* cost, but not having enough money on hand incurs costs of *illiquidity.* What's the optimal balance?

As long as a WCF organization ends up even at the end of the year (no profit, no loss), running cash balances can be zero, or perhaps even negative. Then again, WCF organizations must maintain reasonable cash buffers to protect against possible losses (the probability of such a loss might be determined from Challenge 1). So an optimal balance must be found between minimizing cash balances and maintaining a sufficient buffer as a means of managing risk. At the beginning and end of the year, the cash on hand is theoretically zero. In the middle of the year, it's something else. All of this suggests the existence of a continuous, probabilistic, time-dependent function that, by the way, is unique for each WCF organization. So what is that function?

Challenge 3—Challenging the Paradigm of the Death Spiral

This challenge to some extent contradicts a premise of Challenge 2. The *Death Spiral* is well known in WCF organizations, often spoken of, and goes something like this: "For whatever reason, an organization loses money one year." The labor rates are then adjusted upward in the future to compensate for that loss. The increasing labor rates drive customers and business away, which in the WCF environment is the cost of *illiquidity,* and results in ever-increasing losses. Labor rates and accumulated losses, thus coupled, spiral ever upward and out of control and the organization flies apart financially, not entirely unlike an under-damped, spring-mass system operating at a fundamental frequency.

Managers of WCF organizations make business decisions with the fear of the Death Spiral in mind. But what if the Death Spiral is fiction, or at least overrated? Then managers essentially are making business decisions, such as whether to make or defer a large capital investment, based on the false premise, "better to defer that large investment lest we risk falling into the Death Spiral." The Death Spiral is certainly real. What one needs to question is to what extent the Death Spiral exists?

Private industry has long recognized that in many circumstances customers have a range of price indifference, wherein the decision to buy is not affected by price. There is probably a similar range of price indifference for customers who buy labor from WCF organizations, meaning that the cost of *illiquidity* might

be less than one thinks. This is not to suggest that organizations should behave recklessly and needlessly subject customers to the risk of higher rates. Rather, this is to suggest that there may be room for greater risk to the ultimate, long-term benefit of the customer.

Determining whether such a range of price indifference exists, based on neo-Keynesian principles, and understanding its limits would allow managers to make better-informed business decisions.

Challenge 4—Optimizing the Allocation of Financial Resources

Throughout DoD, decisions on where to make discretionary investments often rely upon multi-attribute decision-making techniques. Multi-attribute decision making is an operations research technique whereby individual alternatives are objectively valued. (The details of this technique are widely known and will not be discussed here.)

Multi-attribute decision making works very well when one is attempting to identify the single best investment alternative. It's very popular because of its simplicity and the fact that it so closely mimics cognitive processes. Unfortunately, multi-attribute decision making is often misapplied.

When a manager is trying to identify a *portfolio* of investment alternatives, higher-level techniques such as integer programming must be employed. Otherwise, the selected portfolio of investments can be significantly sub-optimized. One challenge of using higher-level techniques, such as integer programming, is that the results are often counter-intuitive, making managers suspicious.

Mostly one thinks of the physical plant (capital equipment, military construction, minor construction, maintenance and repair) when thinking of discretionary investments. However, discretionary investments also include hiring, training, and distribution of high-grade authority. The challenge here is to apply more advanced resource allocation techniques to the processes by which managers make their investment decisions as a means of getting more value for the organization and, ultimately, the customer.

Of course, one should keep in mind that this does not even begin to address how an investment alternative should be valued in the first place.

Challenge 5—Valuing Investment Alternatives

Challenge 1 justifies that uncertainty in the planning sector is despised. But that's not always the case. Increasingly, uncertainty is actually being leveraged by the planning sector for competitive advantage.

Very often, high degrees of certainty surround investment options, especially in government. In other words, the costs and benefits of a potential investment are known. In these cases, linear valuation methods such as net present value are appropriately employed to support investment decisions. But what does one do when high degrees of uncertainty surround investment options? As has been found in the pharmaceutical industry and other sectors of the economy, standard linear valuation methods can yield erroneous results. In these cases, non-linear methods for valuing investment options must be considered.

Let's take an excursion for a moment and think about stock options. An option is the right, but not the obligation, to take an action in the future. A stock option often consists of Party A promising to sell stock at a specified price to Party B at a future date. Until that future date, the value of the option rises and falls as the expected value of the stock in question rises and falls. Party B has choices. Party B can ignore the option, sell the option to a third party, or exercise the option to buy at the specified price at a future date. Buying and selling options is a big business; and now an entire industry surrounds the *valuing* of options or option pricing.

Now, think for a moment about the decision to maintain and invest in a facility, capability, or project; or to sell or abandon a facility, capability, or project. Each of these decisions is akin to making a decision on a stock option. Each is called a *Real Option.*

If we're talking about a facility, the facility may be a Research and Development (R&D) facility, a depot facility, or some other type of facility. Irrespective of the type of facility, a facility can have an unknown future value, like the unknown future value of a stock. For example, an R&D facility may (or may not) achieve a major breakthrough several years hence, yielding extremely high value for the programs it supports. A depot facility may (or may not) possess a surge capacity that is absolutely critical during conflict. This is where uncertainty comes in. As such, a facility can have some future value to the DoD that is unknown *a priori.*

When uncertainty is present, linear methods such as net present value can grossly underestimate the value of an option, leading the decision maker to miss incredible investment opportunities. In such cases probabilistic methods can be employed to determine the true value of an option. And using non-linear techniques to value these investment options can lead to better decisions.

Private industry has leveraged these methods with amazing success. But how does one effectively apply these non-linear methods to a WCF organization?

Challenge 6—Measuring and Managing Workforce Productivity

For the most part, federal employees do not contribute directly to Gross Domestic Product (GDP). That's because federal employees, for the most part, do not produce those things that are counted under the heading of GDP. So economists have generally ignored the productivity of federal employees, and traditional methods of measuring workforce productivity (essentially GDP per labor hour, or output over input) do not apply. Nevertheless, federal employees are productive, changes in their productivity do occur, and increases in their

productivity enhance the value of the organization to customers and the DoD.

The difficulty lies in how the output of employees is valued. The product that customers of white-collar, WCF organizations usually purchase is labor hours (h_l). That's the input. The value of those labor hours or *output* to the customer is assumed equal to the cost of those hours, based on the labor rate ($h_l \times r_l$). After adjusting for inflation, the cost of labor does not change appreciably, and the *output* over *input* ($h_l \times r_l / h_l = r_l$) does not change appreciably, thus leaving perceived productivity relatively flat. The error lies in assuming the value of the output is equal to the cost of the applied labor hours, when in reality the value may be (and better be) much, much more.

So, what the changes in productivity in white-collar, WCF environments are, and more important, what contributes to changes in productivity are mostly unknown to us. The challenge here is to find ways of measuring productivity and to identify those things that most contribute to increased productivity. The table on p. __ applies to the U.S. economy overall from 1929 to 1982. Imagine if a manager possessed similar knowledge for a WCF organization.

Knowing what things contribute most to increased productivity would allow that manager to allocate resources much more effectively to the ultimate benefit of the organization and the customer.

So, how does one measure productivity and the contributors to productivity in a WCF organization?

The Way Ahead

As with Hilbert a hundred years ago, the challenges presented here are not intended to represent the complete set of challenges facing WCF organizations today and in the future. It's certainly not an exhaustive list. In fact, some of the challenges presented here may be worded incorrectly and may not even be the correct ones, in that the benefit of pursuing a solution is lacking.

But as with Hilbert a hundred years ago, the challenges presented here are intended to provoke thoughtful consideration of where we are, where we could go, and how we might get there. They are intended to provoke us into viewing and treating the economics of the WCF as the legitimate science it is. Solving these six challenges could lead ultimately to some sort of *Unified Field Theory* for the economics of a WCF.

Hilbert challenged mathematicians to think axiomatically, and the results were phenomenal. We should challenge ourselves to do no less. The opportunities for improving financial management appear unlimited, and we should be grateful that these types of challenges exist. After all, as Hilbert said:

"As long as a branch of science offers an abundance of problems, so long is it alive; a lack of problems foreshadows extinction or the cessation of independent development."

May the economics of the WCF thrive!

Editor's Note: The author welcomes questions or comments on this article. Contact him at BreslinDA@navsea.navy.mil.

DoD Awards $45 Million to Universities for Research Equipment

The Department of Defense (DoD) plans to award $45 million to academic institutions to support the purchase of research instrumentation. The 209 awards to 102 academic institutions are expected to range from about $50,000 to $1 million and average $213,000. All awards are subject to the successful completion of negotiations between DoD research offices and the academic institutions.

The awards are made under the Defense University Research Instrumentation Program (DURIP). The DURIP supports the purchase of state-of-the-art equipment that augments current capabilities or develops new university capabilities to perform cutting-edge defense research.

The DURIP meets a critical need by enabling DoD-supported university researchers to purchase scientific equipment costing $50,000 or more. The researchers generally have difficulty purchasing instruments costing that much under research contracts and grants.

This announcement is the result of a merit competition for DURIP funding conducted by four research offices: the Army Research Office, Office of Naval Research, Air Force Office of Scientific Research, and the Advanced Technology Development Directorate of the Missile Defense Agency. The offices solicited proposals from university investigators working in areas of importance to the DoD, such as information technology, remote sensing, propulsion, electronics and electro-optics, advanced materials, and ocean science and engineering. In response to the solicitation, the research offices received 733 proposals requesting $192 million in support for research equipment.

The complete list of winning proposals is on the Web at http://www.defenselink.mil/news/Mar2002/d20020320dur.pdf.

Editor's Note: This information is in the public domain at http://www.defenselink.mil/news.